THE LIFE HISTORY OF *EUPLOEA ALCATHOE MONILIFERA* (MOORE) AND ITS RELATIONSHIP TO *E. A. EICHHORNI* STAUDINGER (LEPIDOPTERA: NYMPHALIDAE: DANAINAE)

T.A. LAMBKIN

Entomology Building, Indooroopilly Research Centre, Queensland Department of Primary Industries, 80 Meiers Road, Indooroopilly, Qld 4068

Abstract

The immature stages of *Euploea alcathoe monilifera* (Moore) from Boigu Island, Torres Strait, Queensland are described, illustrated and compared with other Australian species of *Euploea* Fabricius. The host plant is established as *Gymnanthera oblonga* (Asclepiadaceae). Adult behaviour is outlined and the subspecies distribution is discussed. Differences between final instar larvae of *E. a. monilifera* and *E. a. eichhorni* Staudinger are discussed, suggesting that the two taxa may be different species.

Introduction

Euploea alcathoe (Godart) occurs from Buru to Aru in the Southern Moluccas, on Numfoor and Japen, throughout New Guinea and its various outlying islands, including Daru, southwards through Torres Strait into northern Queensland and on the Gove Peninsula in northeastern Arnhem Land, Northern Territory (Braby 2000, Fenner 1991, Parsons 1998). In Australia, three subspecies are known (Braby 2000), *E. a. eichhorni* Staudinger, *E. a. monilifera* (Moore) and *E. a. enastri* Fenner. Debate still occurs among Australian workers regarding the treatment by Corbet (1943) and Ackery and Vane-Wright (1984) of *E. a. eichhorni* from Queensland as a subspecies of *E. alcathoe* (Braby 2000, Fenner 1991). Accepting that doubt still surrounds this taxonomic placement, undisputed or 'true' *E. alcathoe* in Australia is restricted to the Northern Territory (*E. a. enastri*) and a number of Torres Strait islands (*E. a. monilifera*) (Braby 2000).

The life history of 'true' *E. alcathoe* has been relatively unknown (Ackery and Vane-Wright 1984, Parsons 1998). Johnson and Valentine (1997) reared adults of *E. a. monilifera* from pupae collected on *Nerium oleander* (Apocynaceae) on Dauan Island in Torres Strait. The reference by Ackery and Vane-Wright (1984) to the egg of *E. alcathoe* recorded by Doherty (1891) from the island of Engano, west of Sumatra, is incorrect, as *E. alcathoe* does not occur in that region (Ackery and Vane-Wright 1984; M. De Baar, pers. comm.). At that time much confusion existed over the identity of *E. alcathoe* and it is believed that Doherty inadvertently referred to the egg of *E. eyndhovii* C. & R. Felder, as this species was in part known as *E. alcathoe* at that time (M. De Baar, pers. comm.).

However, during recent field studies (March 2001) on Boigu Island, Torres Strait, the author observed a female *E. a. monilifera* ovipositing on *Gymnanthera oblonga* (Asclepiadaceae). These eggs were subsequently collected and reared in captivity to adults. The immature stages of *E. a.*

monilifera are described below. Biological information on this species is also provided and its relationship to *E. a. eichhorni* is discussed.

Life History

Host plant (Fig. 1). *Gymnanthera oblonga* (Burm. f.) P. S. Green (Asclepiadaceae).

Egg (Figs 2, 3). Average height 1.5 mm (n = 4); bullet-shaped, yellow, surface with minute dimples arranged in vertical columns (approximately 12 dimples high) and diagonal rows.

First instar larva (Fig. 4). Average length 6 mm (n = 4); head black; body smooth and cylindrical, semitranslucent, yellow-green without bands; a pair of slightly raised protuberances on mesothorax, metathorax and abdominal segments 2 and 8; legs and prolegs black.

Second instar larva (Fig. 5). Average length 11 mm (n = 4); head black; body smooth, yellow-green, faint white transverse bands on abdominal segments; a pair of short, blunt, pale brown filaments on mesothorax, metathorax and abdominal segments 2 and 8, all filaments except mesothoracic shorter than width of body; bases of legs and prolegs yellow-green, legs and prolegs orange.

Third instar larva (Fig. 6). Average length 22 mm (n = 4); head black; body smooth and cylindrical, orange, abdominal segments each with a series of brown and white transverse bands; a pair of dark-brown fleshy filaments on mesothorax, metathorax and abdominal segments 2 and 8, length of filaments as long as the width of the body; bases of legs and prolegs orange, legs and prolegs black.

Fourth instar larva (Fig. 7). Average length 30 mm (n = 4); head black; body smooth and cylindrical, orange, black ventrally, spiracles black, mesothorax with a single entire faint black transverse band, metathorax and each abdominal segment with one white and two black entire transverse bands and a series of black and white dorsal transverse bands; a pair of long black fleshy filaments on mesothorax, metathorax and abdominal segments 2 and 8, length of filaments longer than width of body, thoracic filaments noticeably longer than abdominal filaments; bases of legs and prolegs orange, legs and prolegs black.

Fifth instar larva (Figs 8, 9). Average length 50 mm (n = 4); similar to fourth instar except head black with a white transverse band and white facial markings; transverse bands more prominent on thoracic segments; length of filaments much longer than width of body.

Pupa (Figs 10, 11). Average length 19.4 mm (n = 4); entirely pink at first (Fig. 10); after two days changing to: abdomen shining gold and pink, with wing cases, thorax, eyes and antennae shining silver, brown markings on abdomen and wing-cases, spiracles dark red (Fig. 11).

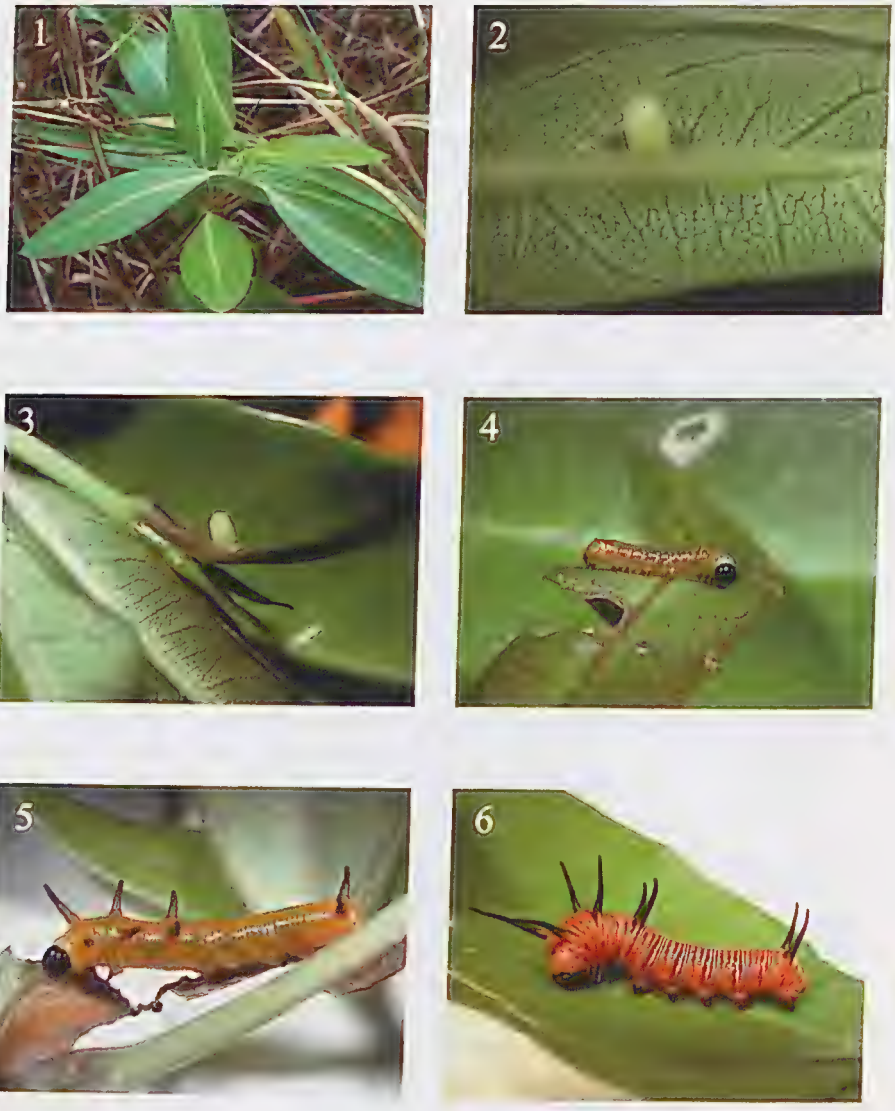
Observations and discussion

Eggs are laid singly on the underside of soft young foliage (Fig. 2) and on tendrils of the host plant (Fig. 3). Upon hatching, the young larva eats the empty eggshell and then commences skeletonising the soft, young foliage. Second and third instar larvae feed exclusively on the soft, young foliage but it is unknown what leaf stage later instars feed upon, as older larvae in captivity developed normally on soft, young foliage of *Parsonsia straminea* (Apocynaceae) when supplies of *G. oblonga* were exhausted. Third to fifth instar larvae rest in a humped posture (Figs 6, 8), typical of larvae of many *Euploea* species (Ackery and Vane-Wright 1984). In March, the time for development from oviposition to adult emergence was approximately four weeks.

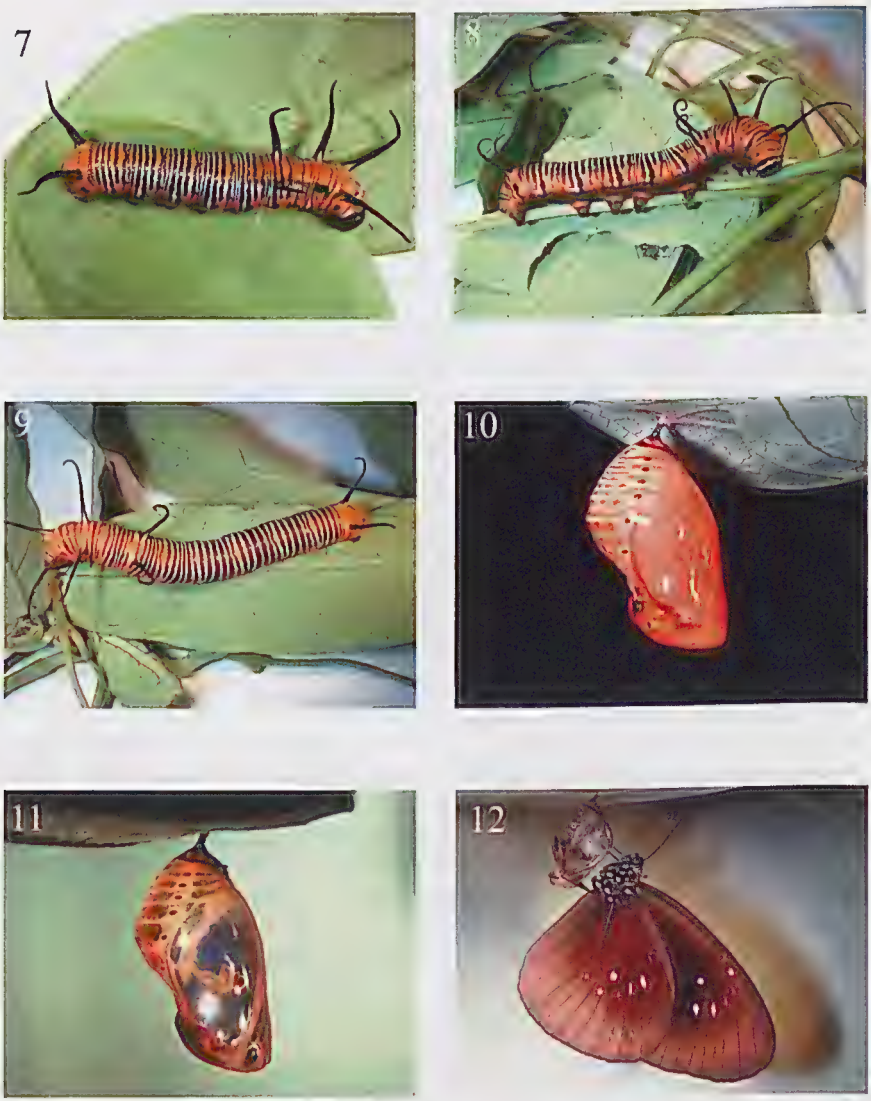
Final instar larvae of *E. a. monilifera* superficially resemble final instar larvae of most other Australian *Euploea* that possess a pair of black filaments on the mesothorax, metathorax and abdominal segments 2 and 8 (overall segments 2, 3, 5 and 11). Apart from *E. batesii* C. & R. Felder, almost all *Euploea* species known from Australia that have this tubercle (filament) formula have black, white or yellow transverse bands and a black head with white facial markings [i.e. *E. core corinna* (W.S. Macleay), *E. algea* (Godart), *E. sylvester* (Fabricius) and *E. alcathoe eichhorni*] (Ackery and Vane-Wright 1984, Braby 2000, McCubbin 1971, Meyer 1997, Parsons 1998, Scheermeyer 1999). Final instar larvae of *E. a. monilifera* differ from these in being predominantly orange in colour, possessing less conspicuous transverse bands (in particular white) and in lacking lateral white stripes or spiracular spots. Compared with the descriptions and illustrations in Parsons (1998), final instar larvae of *E. a. monilifera* most closely resemble those of *E. algea* and *E. eurianassa* Hewitson, the latter endemic to Papua New Guinea.

Gymnanthera oblonga is a widespread tropical vine that predominantly occurs in wet coastal areas and vine thickets in Australia and also occurs in Papua New Guinea (Queensland Herbarium). On Boigu it is a common species that scrambles through blady grass and vine thicket areas close to mangroves. *G. oblonga* is also common on the islands of Saibai (T.A. Lambkin, pers. obs.) and Dauan (S.J. Johnson, pers. comm.), where it grows in the same situations. 'True' *E. alcathoe* may be polyphagous as oviposition and partial development occurred on *G. oblonga*, with later development to adult on *P. straminea*. Johnson and Valentine (1997) and Fenner (1991) also supplied circumstantial evidence that suggests that *Nerium oleander* and *Tylophora benthamii* (Asclepiadaceae), respectively, may also be hosts for this species.

Adults of *E. a. monilifera* (Fig. 12) occur spasmodically in vine thickets, mangroves and in the transitional zone that exists between these two habitats where *G. oblonga* grows. They are also found in grassy areas bordering mangroves and in inhabited areas visiting blossom.



Figs 1-6. (1) *Gymnanthera oblonga* [length of leaf at bottom left hand corner 100 mm]; (2-6) *Euploea alcathoe monilifera*: (2-3) egg [height 1.5 mm]; (4) first instar larva [length 6 mm]; (5) second instar larva [length 11 mm]; (6) third instar larva [length 22 mm].



Figs 7-12. *Euploea alcathoe monilifera*: (7) fourth instar larva [length 30 mm]; (8-9) fifth instar larva [length 50 mm]; (10-11) pupa [length 19.4 mm]; (12) newly emerged adult female [forewing length 40 mm].

Both sexes normally fly strongly and quickly with a jerky or lurching action with long wing beats and thus can be difficult to collect. They are most active in sunny weather but can be seen late in the afternoon feeding at blossom [*Melanthera biflora* (L.) Wild (Asteraceae) and *Catharanthus roseus* (L.) G. Don (Apocynaceae)], where they fly more slowly with a gliding action and can be easily approached and collected. They are seen mostly during the wetter months from December to May and it is assumed that during the dry season they, like many tropical *Euploea* species, enter into a reproductive dormancy (Scheermeyer 1999). The dependence of younger larvae on soft, young foliage of *G. oblonga* also points to such a survival strategy. On mainland Australia, reproductive dormancy in *Euploea* is generally linked to aggregation behaviour (Scheermeyer 1999). Although *E. s. sylvester* and *E. core corinna* have been observed on Prince of Wales Island aggregating in large numbers along sheltered creeks in July (T.A. Lambkin, pers. obs.), this behaviour has not been recorded in either *E. a. monilifera* in Torres Strait or *E. a. enastri* in Arnhem Land (Fenner 1991).

Braby (2000) briefly summarised the Torres Strait butterfly fauna and outlined particular island groups where *E. a. monilifera* was known. Apart from this overview, substantial collection records and field observations for this species have been made (S.S. Brown, S.J. Johnson, A.I. Knight, T.A. Lambkin, C.E. Meyer, P.S. Valentine). In summary, the above collection records all indicate that *E. a. monilifera* is rarely seen on Boigu, but can sometimes be common on Saibai and Dauan in vine thickets that border mangroves (A.I. Knight pers. comm.). Furthermore, the discovery of immature stages on Boigu further suggests that this species is most likely resident on all three islands. Consequently, specimens collected occasionally from other Torres Strait islands (De Baar 1988, Lambkin and Knight 1990, Waterhouse and Lyell 1914) and from the Australian mainland (Waterhouse and Lyell 1914), are most probably vagrants as adults are strong fliers (M. De Baar, pers. comm.). Therefore, the distribution of *E. a. monilifera* in Torres Strait seems to be confined to the far northern islands of Boigu, Saibai and Dauan (Fig. 13).

The lowering of the status of *E. eichhorni* to subspecific rank (Ackery and Vane-Wright 1984, Braby 2000, Corbet 1943) was based mainly on similarities in the external morphology of the males of *E. eichhorni* and *E. alcathoe*. Males of both species have hindwing specula, bowed forewing dorsa and black ground-coloured forewings that lack sex brands. The inclusion of *E. eichhorni* in *E. alcathoe* led Ackery and Vane-Wright (1984) and Braby (2000) into publishing descriptions of the immature stages of *E. eichhorni* (ex McCubbin 1971) as indicative of *E. alcathoe*. At that time little was known of the early stages of 'true' *E. alcathoe*. Now that the immature stages of *E. a. monilifera* are known, there are some notable differences between the final instar larvae of *E. a. monilifera* and *E. a. eichhorni*.

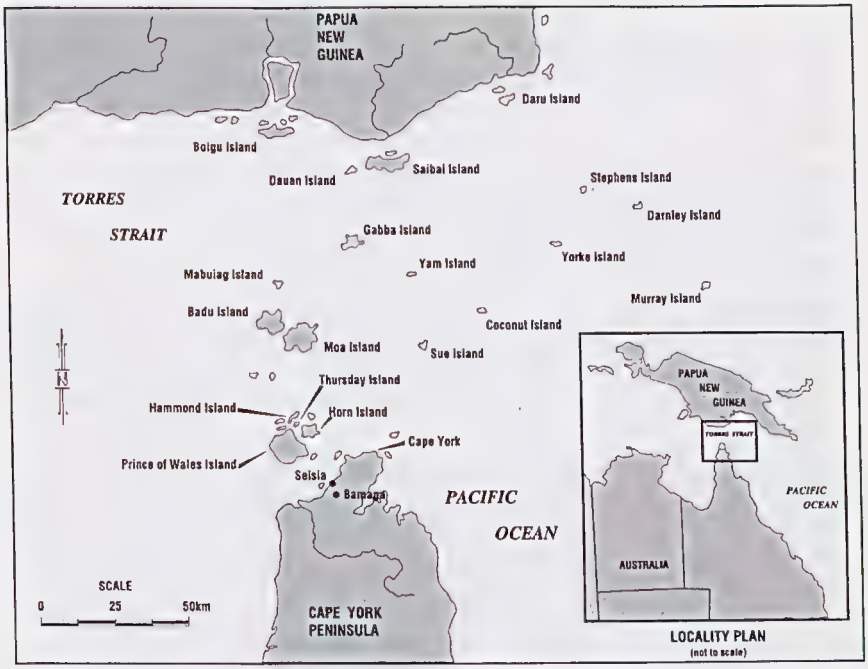


Fig. 13. Map of Torres Strait, Queensland.

The major differences between final instar larvae of both taxa are: the body colour of *E. a. monilifera* is orange, not white as in *E. a. eichhorni*; *E. a. monilifera* has much fewer transverse bands, in particular white bands, than does *E. a. eichhorni*; *E. a. monilifera* has noticeably longer filaments on metathorax and abdominal segments 2 and 8 than does *E. a. eichhorni*; and *E. a. monilifera* lacks the lateral white stripe and spiracular spots present in *E. a. eichhorni*.

Although some colour variation is known in final instar larvae of *E. core* (Scheermeyer 1999), the number and colour of the transverse bands appears to be constant within each species. Therefore the differences between final instar larvae of *E. a. monilifera* and *E. a. eichhorni*, in colour and morphology, strongly suggests that the two taxa are not conspecific but are distinct allopatric species. Despite *E. a. eichhorni* being well known in Queensland, its life history has been poorly documented. Once this is done and particular important features such as egg sculpture pattern (Kitching 1985; M.P. Zalucki, pers. comm.) documented, the correct taxonomic placement of *E. a. eichhorni* can be made.

Acknowledgments
I thank the Queensland Herbarium for the identification of and information about *G. oblonga*, B.M. Waterhouse (AQIS) for identification of nectar

source plant species, and M. De Baar, S.J. Johnson, A.I. Knight and M.P. Zalucki for personal communications. Availability of collection records from S.S. Brown, S.J. Johnson, A.I. Knight, C.E. Meyer and P.S. Valentine is greatly appreciated and thanks are also extended to M. De Baar and J.F. Donaldson for reviewing the manuscript. M. Melloy provided valuable assistance in the preparation of the colour plates and special thanks are also extended to the northern Torres Strait Islands' councils and people for their cooperation and assistance during the time of my field work.

References

ACKERY, P.R. and VANE-WRIGHT, R.I. 1984. *Milkweed butterflies*. British Museum (Natural History), London; ix + 425 pp.

BRABY, M.F. 2000. *Butterflies of Australia: their identification, biology and distribution*. 2 vols. CSIRO, Collingwood; xx + 976 pp.

CORBET, A.S. 1943. A key for the separation of the Indo-Australian and African species of the genus *Euploea* F. (Lepidoptera: Danaidae). *Proceedings of the Royal Entomological Society of London (B)* **12**: 17-22.

DE BAAR, M. 1988. Insects collected during a trip to Torres Strait 27 March to 10 April, 1987. *News Bulletin of the Entomological Society of Queensland* **15**: 107-117.

DOHERTY, W. 1891. A list of the butterflies of Engano, with some remarks on the Danaidae. *Journal of the Asiatic Society of Bengal, Calcutta* **60**(2): 4-32.

FENNER, T.L. 1991. A new subspecies of *Euploea alcathoe* (Godart) (Lepidoptera: Nymphalidae) from the Northern Territory, Australia. *Australian Entomological Magazine* **18**(4): 149-155.

JOHNSON, S.J. and VALENTINE, P.S. 1997. Further observations and records for butterflies (Lepidoptera) in Northern Australia. *Australian Entomologist* **24**(4): 155-158.

KITCHING, I.J. 1985. Early stages and the classification of the milkweed butterflies (Lepidoptera: Danainae). *Zoological Journal of the Linnean Society* **85**: 1-97.

LAMBKIN, T.A. and KNIGHT, A.I. 1990. Butterflies recorded from Murray Island, Torres Strait, Queensland. *Australian Entomological Magazine* **17**: 101-112.

McCUBBIN, C. 1971. *Australian butterflies*. Nelson, Melbourne; 206 pp.

MEYER, C.E. 1997. Notes on the life history and variation in adult forms of *Euploea sylvester pelor* Doubleday (Lepidoptera: Nymphalidae: Danainae). *Australian Entomologist* **24**(2): 73-77.

PARSONS, M.J. 1998. *The butterflies of Papua New Guinea: their systematics and biology*. Academic Press, London; xvi + 736 pp.

SCHEERMEYER, E. 1999. The crows, *Euploea* species, with notes on the Blue Tiger, *Tirumala hamata* (Nymphalidae: Danainae). Pp 191-216, in: R.L. Kitching, E. Scheermeyer, R.E. Jones and N.E. Pierce (eds). *Biology of Australian butterflies. Monographs on Australian Lepidoptera*. Vol. 6. CSIRO Publishing, Canberra; xvi + 395 pp.

WATERHOUSE, G.A. and LYELL, G. 1914. *The butterflies of Australia*. Angus and Robertson, Sydney; vi + 239 pp.